QCM – A LaTeX 2ε package for making Multiple Choices Questionnaires*

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November 27, 2004

Abstract

QCM is a package for making multiple choices questionnaires ("QCM" is the corresponding French acronym) under LaTeX 2ε. A special environment allows you to define questions and possible answers. You can specify which answers are correct and which are not. QCM not only formats the questions for you, but also generates a "form" (a grid that your students will have to fill in), and a "mask" (the same grid, only with correct answers properly checked in). You can then print the mask on a slide and correct the questionnaires more easily by superimposing the mask on top of students' forms.

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1 Using QCM (attention users of version 1)

As of version 2.0, QCM comes both in style and class form. The style provides all the basic features: making questions, generating the form and the mask. . . You can use it with any class you want, which is useful when you want to incorporate multiple choice questions in a larger document (a full exam for instance).

If you want to make simple multiple choice questionnaires, with just a list of questions, you can alternately use the class which provides some basic formatting on top of the style itself.

2 The QCM Style

First of all, please note that QCM requires the packages `ifthen`, `calc` and `tabularx`. As of version 2.1, the `verbatim` package is also required. You don't have to require these packages explicitly though. As long as LaTeX 2ε is able to locate them, they will be used automatically.

In order to use the QCM style, say `\usepackage[`⟨*options*⟩`]{qcm}` in the preamble of your document. The available options are described along the text, where appropriate.

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*This document describes QCM v2.1, class release date 2004/11/27, style release date 2004/11/27.

2.1 Creating Questions

Here's a simple example demonstrating how to produce a new question:

```
\begin{question}{What is the color of Henri the Fourth's white horse?}
  \false black,
  \true white,
  \false yellow,
  \false red.
\end{question}
\begin{correction}
The correct answer is white, because it's in the question.
\end{correction}
```

2.1.1 The `question` environment

`question`   The `question` environment allows you to insert questions into your document. It takes one mandatory argument which specifies the actual question's text. The question will be displayed in a frame box, the size of the line.

`\true`   The proposed answers are displayed below the question in a list fashion (the `\false` `question` environment is a list-based one). Instead of using `\item` however, use either `\true` or `\false` to insert a possible answer.

2.1.2 Question Numbers

The `question` environment is associated with a LaTeX counter named `question`. This counter stores the number of the next (or current) question. It is initialized to 1, and automatically incremented at the end of `question` environments. You might want to use it to format question titles. For instance, you could decide that each question belongs to a subsection in the `article` class, and use something like this before each question: `\subsection*{Question \thequestion}`

2.2 The Form and the Mask

Based on the questions appearing in your document, QCM has the ability to generate a "form" (a grid that your students will have to fill in), and a "mask" (the same grid, only with correct answers properly checked in). This can make the correction process easier.

`\makeform`   To generate a form and a mask, use the macros `\makeform` and `\makemask`. `\makemask` QCM uses two auxiliary files to build them. These files have respectively an extension of `frm` and `msk`. If you use these macros, you will need two passes of LaTeX 2$_\varepsilon$ in order to get a correctly formatted document.

2.3 Typesetting corrections

`correction`   As of version 2.1, QCM comes with a "correction" mode which allows you to automatically typeset and distribute corrections to your students. These corrections are slightly modified versions of your questionnaire: each possible answer is prefixed with a small symbol (a visual clue) indicating whether the answer was correct or wrong. In addition, you can typeset explanations below each question.

To activate the correction mode, use the `correction` option. It is off by default.

To typeset explanations below the questions, use the `correction` environment (no argument). The contents of this environment is displayed only in `correction` mode. In normal mode, it is simply discarded.

In addition, note that QCM cancels the actions performed by `\makeform` and `\makemask` in `correction` mode. This is to avoid further edition of the source when typesetting a correction.

2.4 Important Note

Currently, QCM requires that you provide a constant number of proposed answers across all questions in your QCM. This is something natural when you want to build forms, but this might me too restrictive otherwise, I'm not sure, so it is possible that this restriction will be removed in future versions.

Currently, there is a built-in mechanism for checking that the number of proposed answers remains constant: when QCM encounters the first occurrence of the `question` environment, it remembers the number of proposed answers from there. Afterwards, any noticed difference in subsequent occurrences will generate an error. As a consequence, you never have to tell QCM explicitly what that number is.

2.5 Customizing the QCM style

2.5.1 The question environment

`\questionspace`   `\questionspace` is the amount of extra vertical space to put under the question, before the list of proposed answers. This is a LaTeX length that defaults to `0pt`.

`\answerstitlefont`   Before the list of possible answers, a short title is displayed (for English, it reads "Possible answers:"). The `\answerstitlefont` macro takes one mandatory argument which redefines the font to use for the answers title. By default, `\bfseries` is used.

`\answernumberfont`   Each proposed answer in the list is numbered automatically (and alphabetically). The `\answernumberfont` macro takes one mandatory argument which redefines the font to use for displaying the answer number. By default, `\bfseries` is used.

2.5.2 The Form and the Mask

`\headerfont`   The `\headerfont` macro takes one mandatory argument which redefines the font to use for the headers (first line and first column) of the form and mask arrays. By default, `\bfseries` is used.

`\X`   In the mask, correct answers are checked in by filling the corresponding cell with an "X" character. If you want to change this, call the `\X` macro with one (mandatory) argument.

2.5.3 The correction

`\truesymbol`
`\falsesymbol`   In correction mode, labels in front of answers are modified to give a visual clue about whether the answer was correct or wrong. By default, a cross and a small arrow are used. You can change these symbols by using the `\truesymbol` and

`\falsesymbol` macros. For instance, you could give a fancier look to your correction by using the `pifont` package and issuing:

```
\truesymbol{\ding{'063}~}
\truesymbol{\ding{'067}~}
```

`\correctionstyle` The appearance of the contents of the `correction` environment can be adjusted by using the `\correctionstyle` macro. By default, `\itshape` is used.

2.5.4 Internationalization

english QCM currently supports English, and French. You can select the language you
french, francais want to use by using the corresponding option. The `french` and `francais` options are synonyms. If you want a finer grain on the language-dependent parts of QCM, the following macros are provided.

`\answerstitle`   This macro takes one mandatory argument which lets you redefine the answers'titles. For English, the answers title defaults to "Possible answers:".

3   The **QCM** Class

The QCM class provides a wrapper around the style to allow you to format simple multiple choice questionnaires, with just a list of questions.

In order to use the QCM class, say `\documentclass[`⟨options⟩`]{qcm}` at the beginning of your document. The available options are described along the text, where appropriate. Note that the underlying QCM style is loaded automatically.

3.1   Standard Class Features

3.2   Page Size and layout

a4paper The `a4`, `a5`, `b4`, `letter`, `legal` and `executive` "paper" options allow you to
a5paper select the type of page format you want. By default, `letterpaper` is used. The
b4paper `landscape` options switches the horizontal and vertical settings. I'm not sure why
letterpaper I propose this option. Nobody wants to write a QCM in landscape mode, right?
legalpaper   QCM also supports the standard `oneside` and `twoside` class options. By
executivepaper default, `oneside` is used. In `twoside` mode, odd and even pages have a different
landscape geometry and headings layout.
oneside
twoside
3.3   Font Size

10pt The `10pt`, `11pt` and `12pt` options let you choose the size of the default font you
11pt want to use. By default, `10pt` is used.
12pt

3.4   Output Mode

final In `draft` mode, a black rule will be drawn at the end of overfull lines (as done by
draft standard classes).

3.5 Page styles

QCM supports the standard LaTeX page style mechanism. Available styles are
`empty`, `plain`, `headings` and `myheadings`. These styles have their usual meaning,
except that there are no sectioning commands in the QCM class. By default, the
page style is `plain`. Also, note that the form and the mask have an empty page
style, whatever the setting for the rest of the document.

3.6 Title

`\title` The `\title` macro takes one mandatory argument which defines a title for your
questionnaire (repeated on the form and the mask). It can be used in the document's preamble only. The title will be centered on the page.

`\titlefont` The `\titlefont` macro takes one mandatory argument which redefines the
font to use for the title. By default, `\LARGE\bfseries` is used.

`\titlespace` `\titlespace` is the amount of extra vertical space to put after the title. This
is a LaTeX length that defaults to `20pt`.

`\maketitle` If you have defined a title, make it appear by calling `\maketitle` after the
beginning of your document. If you call `\maketitle` without having defined a
title, an error will be generated.

3.7 Modifications to the question environment

The QCM class modifies the `question` environment so as to display a title before
each question (something that you would probably do with a sectioning command
in other classes). This title is displayed in a frame box, the size of a quarter of
the line. For English, the default reads "Question n.$\langle X \rangle$:".

3.8 Modifications to \makeform and \makemask

The QCM class modifies `\makeform` and `\makemask` along the following lines: each
grid is printed on a page of its own, and the document's title is repeated on top
of each. Also, the page style is set to `empty`.

3.9 Customizing the QCM class

3.9.1 The question titles

`\questiontitlefont` The `\questiontitlefont` macro takes one mandatory argument which redefines
the font to use for each question title. By default, `\bfseries` is used.

`\questiontitlespace` `\questiontitlespace` is the amount of extra vertical space to put after the
question title (and before the questions' text). This is a LaTeX length that defaults
to `5pt`.

`\questionsepspace` In addition, questions are separated from each other by some vertical space.
`\questionsepspace` is the amount of extra vertical space to put between each
question block. This is a LaTeX length that defaults to `20pt`.

3.9.2 Internationalization

english QCM currently supports English, and French. You can select the language you
french, francais want to use by using the corresponding option. The `french` and `francais` options

are synonyms. If you want a finer grain on the language-dependent parts of QCM, the following macros are provided.

`\questiontitle`   This macro takes one mandatory argument which lets you redefine the questions'titles. For English, the question title defaults to "`Question N.\thequestion:`".

4   AUC-TeX support

AUC-TeX is a powerful major mode for editing TeX documents in Emacs or XEmacs. In particular, it provides automatic completion of macro names once they are known. QCM supports AUC-TeX by providing a style file named `qcm.el` which contains AUC-TeX definitions for the relevant macros. This file should be installed to a location where AUC-TeX can find it (usually in a subdirectory of your LaTeX styles directory). Please refer to the AUC-TeX documentation for more information on this.

For people already knowing AUC-TeX: note that the AUC-TeX command `LaTeX-insert-item` (usually bound to `M-Ret`) inserts `\false` by default in a QCM, since it replaces `\item`. If you want to insert a `\true`, use a prefix.

5   Style Code

```
1 \NeedsTeXFormat{LaTeX2e}
2 \ProvidesPackage{qcm}[2004/11/27 v2.1
3                       Multiple Choice Questionnaire style for LaTeX2e]
4
5 \RequirePackage{ifthen}
6 \RequirePackage{calc}
7 \RequirePackage{verbatim}
8 \RequirePackage{tabularx}
9
```

5.1   The Form and Mask

Here are the customization parameters:

```
10 \def\@headerfont{\bfseries}
11 \newcommand\headerfont[1]{\gdef\@headerfont{#1}}
12
13 \def\@X{X}
14 \newcommand\X[1]{\gdef\@X{#1}}
15
```

We use two new column types in the form and mask arrays: Q for header cells and D for data cells. We also use centered cells for the X specification. Note that this might clash with a user setting one day, but let's not anticipate problems.

```
16 \def\pbs#1{\let\tmp=\\#1\let\\=\tmp}
17 \newcolumntype{D}{>{\pbs\centering}X}
18 \newcolumntype{Q}{>{\@headerfont}X}
19
20 \renewcommand\tabularxcolumn[1]{m{#1}}
21
22 \newcommand\makeform@nocorrection{%
23   \addtocontents{frm}{\protect\end{tabularx}}
```

```
24    \@starttoc{frm}}
25 \newcommand\makeform@correction{%
26    \addtocontents{frm}{\protect\end{tabularx}}}
27
28 \newcommand\makemask@nocorrection{%
29    \addtocontents{msk}{\protect\end{tabularx}}
30    \@starttoc{msk}}
31 \newcommand\makemask@correction{%
32    \addtocontents{msk}{\protect\end{tabularx}}}
33
```

5.2   The `question` Environment

Here are the customization parameters:

```
34 \newlength\questionspace
35 \setlength\questionspace{0pt}
36
37 \newcommand\answerstitle[1]{\gdef\@answerstitle{#1}}
38
39 \def\@answerstitlefont{\bfseries}
40 \newcommand\answerstitlefont[1]{\gdef\@answerstitlefont{#1}}
41
42 \def\@answernumberfont{\bfseries}
43 \newcommand\answernumberfont[1]{\gdef\@answernumberfont{#1}}
44
```

The `question` counter starts at one, and is incremented at the end of each question.

```
45 \newcounter{question}\stepcounter{question}
46 \newcounter{@choice}
47
```

The macro `\@initorcheck` is called at the end of each question. After the first one, it initializes the number of proposed answers (this must be constant across all questions). This is used to build the form and mask arrays description lines, and initialize the auxiliary files. Afterwards, it redefines itself so that subsequent calls will just check that the number of answers remains the same across all questions.

```
48 \def\@initorcheck{%
49    \xdef\@choices{\the@choice}%
50    \setcounter{@choice}{1}%
51    \gdef\@arraydesc{|Q||}%
52    \gdef\@headerline{}%
53    \whiledo{\not{\value{@choice}>\@choices}}{
54      \xdef\@arraydesc{\@arraydesc D|}
55      \def\@appendheader{\g@addto@macro\@headerline}
56      \@appendheader{&\protect\@headerfont}
57      \edef\@the@choice{{\alph{@choice}}}
58      \expandafter\@appendheader\@the@choice
59      \stepcounter{@choice}}%
60    \addtocontents{frm}{%
61      \protect\begin{tabularx}{\protect\linewidth}{\@arraydesc}
62      \protect\hline
63      \@headerline\protect\\\protect\hline\protect\hline}%
64    \addtocontents{msk}{%
```

```
65     \protect\begin{tabularx}{\protect\linewidth}{\@arraydesc}
66     \protect\hline
67     \@headerline\protect\\\protect\hline\protect\hline}%
68   \gdef\@initorcheck{%
69     \ifthenelse{\value{@choice} = \@choices}{}{%
70       \ClassError{QCM}{Question \thequestion: wrong number of choices
71         (\the@choice\space instead of \@choices)}{%
72         Questions must all have the same number of proposed answers.%
73         \MessageBreak
74         Type X <return> to quit, fix your QCM and rerun LaTeX.}}}}
75
```

A minipage environment is used in order to prevent page breaks in the middle of
a question.

```
76 \newenvironment{question}[1]{%
77   %% \begin{question}
78   \begin{minipage}{\textwidth}
```

Each line in the form and mask arrays is stored in the macros \@formanswerline
and \@maskanswerline. They are initialized here, updated progressively by each
call to \true or \false, ...

```
79     \xdef\@formanswerline{\@questionheader}%
80     \xdef\@maskanswerline{\@questionheader}%
81     \fbox{\parbox[c]{\linewidth}{#1}}
82     \vspace\questionspace\par
83     {\@answerstitlefont\@answerstitle}
84     \begin{list}{\@answernumberfont\alph{@choice}.~}{\usecounter{@choice}}}{%
85   %% \end{question}
86     \end{list}
87     \@initorcheck%
```

... and added to the form and mask auxiliary files here:

```
88     \addtocontents{frm}{\@formanswerline\protect\\\protect\hline}%
89     \addtocontents{msk}{\@maskanswerline\protect\\\protect\hline}%
90   \end{minipage}
91   \stepcounter{question}}
92
93 \def\@truesymbol{$\rightarrow$~}
94 \def\@falsesymbol{$\times$~}
95 \newcommand\truesymbol[1]{\gdef\@truesymbol{#1}}
96 \newcommand\falsesymbol[1]{\gdef\@falsesymbol{#1}}
97
98 \def\@true@nocorrection{\item}
99 \def\@false@nocorrection{\item}
100 \def\@true@correction{\item[\@truesymbol\refstepcounter{@choice}]}
101 \def\@false@correction{\item[\@falsesymbol\refstepcounter{@choice}]}
102
103 \newcommand\true{%
104   \xdef\@formanswerline{\@formanswerline&}%
105   \xdef\@maskanswerline{\@maskanswerline&\@X}%
106   \@true}%
107 \newcommand\false{%
108   \xdef\@formanswerline{\@formanswerline&}%
109   \xdef\@maskanswerline{\@maskanswerline&}%
110   \@false}%
```

5.3   The correction environment

Here, we only define the visible version of the `correction` environment. The other one is provided by `verbatim`'s comment environment.

```
112 \def\@correctionstyle{\itshape}
113 \newcommand\correctionstyle[1]{\gdef\@correctionstyle{#1}}
114
115 \newenvironment{@correction}{\@correctionstyle}{}
116
```

5.4   Internationalization

```
117 \DeclareOption{english}{%
118   \def\@questionheader{Question n.\thequestion}
119   \answerstitle{Possible answers:}}
120 \DeclareOption{french}{%
121   \def\@questionheader{Question n$^o$~\thequestion}
122   \answerstitle{R\'eponses possibles~:}}
123 \DeclareOption{francais}{%
124   \ExecuteOptions{french}}
125
```

5.5   Options Processing

Note that we don't use `\let` but `\def` to implement the correct behavior of `\makeform` and `\makemask`. This is because when using the class, the underlying macros might be redefined, so we want to use their latest definition.

```
126 \DeclareOption{nocorrection}{%
127   \let\@true\@true@nocorrection
128   \let\@false\@false@nocorrection
129   \let\correction\comment
130   \let\endcorrection\endcomment
131   \def\makeform{\makeform@nocorrection}
132   \def\makemask{\makemask@nocorrection}}
133 \DeclareOption{correction}{%
134   \let\@true\@true@correction
135   \let\@false\@false@correction
136   \let\correction\@correction
137   \let\endcorrection\end@correction
138   \def\makeform{\makeform@correction}
139   \def\makemask{\makemask@correction}}
140
141 \ExecuteOptions{english,nocorrection}
142 \ProcessOptions
143
```

6   Class Code

```
144 \NeedsTeXFormat{LaTeX2e}
145 \ProvidesClass{qcm}[2004/11/27 v2.1
146                     Multiple Choice Questionnaire class for LaTeX2e]
```

```
147
148 \RequirePackage{qcm}[2004/11/09]
149
```

6.1   The Title

```
150 \def\@titlefont{\LARGE\bfseries}
151 \newcommand\titlefont[1]{\gdef\@titlefont{#1}}
152 \@onlypreamble\titlefont
153
154 \newlength\titlespace
155 \setlength\titlespace{20pt}
156
157 \@onlypreamble\title
158
```

\maketitle informs QCM that the title should be repeated on the form and mask pages by defining \@maketitle.

```
159 \def\@make@title{%
160   \begin{center}
161     \@titlefont\@title
162   \end{center}
163   \vspace\titlespace}
164 \let\@maketitle\empty
165 \newcommand\maketitle{%
166   \@make@title%
167   \let\@maketitle\@make@title}
168
```

6.2   The Form and Mask

The qcm style \makeform and \makemask macros are saved and wrapped into new ones that first repeat the document's title on a new page. The page style is also set to empty.

For a reason I don't recall anymore, \addtocontents fails to write anything in the auxiliary files when nothing has been written on the page yet. To cope with this problem, we restate the title first.

```
169 \let\old@makeform@nocorrection\makeform@nocorrection
170 \def\makeform@nocorrection{%
171   \newpage
172   \@maketitle
173   \thispagestyle{empty}
174   \old@makeform@nocorrection}
175
176 \let\old@makemask@nocorrection\makemask@nocorrection
177 \def\makemask@nocorrection{%
178   \newpage
179   \@maketitle
180   \thispagestyle{empty}
181   \old@makemask@nocorrection}
182
```

6.3   The question Environment

```
183 \newcommand\questiontitle[1]{\gdef\@questiontitle{#1}}
```

```
184
185 \def\@questiontitlefont{\bfseries}
186 \newcommand\questiontitlefont[1]{\gdef\@questiontitlefont{#1}}
187
188 \newlength\questiontitlespace
189 \setlength\questiontitlespace{5pt}
190
191 \newlength\questionsepspace
192 \setlength\questionsepspace{20pt}
```

The real space used is `\@questionsepspace`. It is initialy set to 0 to prevent extra space from appearing before the first question. It is redefined to the real value at the end of the `question` environment.

```
193 \gdef\@questionsepspace{0pt}
194
```

The qcm style `question` environment is saved and wrapped into a new one that outputs a question title.

```
195 \let\old@question\question
196 \let\old@endquestion\endquestion
197 \renewenvironment{question}[1]{%
198   %% \begin{question}
199   \vspace\@questionsepspace
200   \fbox{\parbox[c]{0.25\linewidth}{\@questiontitlefont\@questiontitle}}
201   \nopagebreak\vspace\questiontitlespace\par
202   \old@question{#1}}{%
203   %% \end{question}
204   \old@endquestion
205   \gdef\@questionsepspace{\questionsepspace}}
206
```

6.4 Language Processing

```
207 \DeclareOption{english}{%
208   \questiontitle{Question N.\thequestion:}}
209 \DeclareOption{french}{%
210   \questiontitle{Question N$^{o}$~\thequestion~:}}
211 \DeclareOption{francais}{%
212   \ExecuteOptions{french}}
213
```

6.5 Standard Class Processing

```
214 \DeclareOption{a4paper}{
215   \setlength\paperheight{297mm}
216   \setlength\paperwidth{210mm}}
217 \DeclareOption{a5paper}{
218   \setlength\paperheight{210mm}
219   \setlength\paperwidth{148mm}}
220 \DeclareOption{b5paper}{
221   \setlength\paperheight{250mm}
222   \setlength\paperwidth{176mm}}
223 \DeclareOption{letterpaper}{
224   \setlength\paperheight{11in}
225   \setlength\paperwidth{8.5in}}
226 \DeclareOption{legalpaper}{
227   \setlength\paperheight{14in}
```

```
228    \setlength\paperwidth{8.5in}}
229  \DeclareOption{executivepaper}{
230    \setlength\paperheight{10.5in}
231    \setlength\paperwidth{7.25in}}
232  \DeclareOption{landscape}{
233    \setlength\@tempdima{\paperheight}
234    \setlength\paperheight{\paperwidth}
235    \setlength\paperwidth{\@tempdima}}
236
237  \DeclareOption{10pt}{\def\@ptsize{0}}
238  \DeclareOption{11pt}{\def\@ptsize{1}}
239  \DeclareOption{12pt}{\def\@ptsize{2}}
240
241  \DeclareOption{oneside}{\@twosidefalse\@mparswitchfalse}
242  \DeclareOption{twoside}{\@twosidetrue\@mparswitchtrue}
243
244  \DeclareOption{draft}{\setlength\overfullrule{5pt}}
245  \DeclareOption{final}{\setlength\overfullrule{0pt}}
246
247  \ExecuteOptions{english,letterpaper,10pt,oneside,final}
248  \ProcessOptions
249
250  \input{size1\@ptsize.clo}
251  \setlength\parindent{0pt}
252  \setlength\parskip{0pt}
253  \setlength\tabcolsep{6pt}
254  \setlength\arrayrulewidth{0.4pt}
255  \raggedbottom
256  \onecolumn
257  \pagestyle{plain}
258  \pagenumbering{arabic}
259
260  \if@twoside
261    \def\ps@headings{%
262      \let\@oddfoot\@empty\let\@evenfoot\@empty
263      \def\@evenhead{\thepage\hfil\slshape\leftmark}%
264      \def\@oddhead{{\slshape\rightmark}\hfil\thepage}%
265      \let\@mkboth\markboth
266    }
267  \else
268    \def\ps@headings{%
269      \let\@oddfoot\@empty
270      \def\@oddhead{{\slshape\rightmark}\hfil\thepage}%
271      \let\@mkboth\markboth
272    }
273  \fi
274  \def\ps@myheadings{%
275    \let\@oddfoot\@empty\let\@evenfoot\@empty
276    \def\@evenhead{\thepage\hfil\slshape\leftmark}%
277    \def\@oddhead{{\slshape\rightmark}\hfil\thepage}%
278    \let\@mkboth\@gobbletwo
279  }
280
```

Well, I think that's it. Enjoy using QCM!